REMARKS

This response addresses the issues raised by the Examiner in the Office Action mailed May 25, 2005. Initially, Applicants would like to thank the Examiner for the careful consideration given in this case. The claims were 2-3 and 7-15. Claim 15 has been currently amended. Thus, claims 2-3 and 7-15 are pending in this case all to more clearly and distinctly claim Applicants' invention. Applicants respectfully request entry of the amendments as they place the application in condition for allowance or in better condition for possible appeal.

Applicants thank the Examiner for the interview conducted on August 17, 2005. In the Interview, claim 15 and Huttinger was discussed in detail. As a result of the discussion, the Examiner indicated that by amending claim 15 to recite "pre-reacting the process gas on contact with the large surface of the heat-resistant material" would overcome the Huttinger reference provided Applicant submit more information regarding the pre-reaction. The pre-reaction is discussed in detail below. Accordingly, claim 15 is amended to overcome the Huttinger reference.

Rejection Based On Huttinger 35 U.S.C. § 102 (b)

The Examiner rejects Claims 2-3, 7-9 and 13-15 under 35 U.S.C. § 102 (b) as being anticipated by Huttinger. Applicants respectfully traverse this rejection.

The Examiner argues that Huttinger teaches a CVI process for depositing SiC into a preform. The Examiner states that Huttinger also teaches using MTS as the precursor in a hydrogen carrier gas and the pressure and the porosity ranges of the present invention. Lastly, the Examiner argues that Huttinger teaches a process temperature of 1100 °C. Applicants respectfully disagree with the Examiner.

Currently amended independent claim 15 claims a process for producing a high temperature stable fiber composite ceramic by chemical vapor infiltration with methyltrichlorosilane in hydrogen on fiber scrims of carbon fiber preforms or silicon carbide fiber preforms, wherein the partial pressure ratio of hydrogen to methyltrichlorosilane is adjusted between 4 and 8, the process further comprises: adjusting the process pressure to $\geq$ 0.6 bar absolute; adjusting the process temperature to $\geq$ 1100°C; and arranging a heat-resistant material with a large surface between a gas feed in the reaction space and between the fiber scrims of carbon fiber preforms or silicon carbide fiber preforms to be infiltrated for pre-reacting the process gas on contact with the large surface of the heat-resistant material.

For a rejection to be sustained under 35 U.S.C. § 102 (b) each an every element of the claimed invention must be disclosed or cited in the prior art reference. Huttinger teaches a method for chemical vapor infiltration of carbon and silicon carbide based on diffusion in a porous structure and functions isothermally. See Abstract and Specification at Col. 2 and 3, lines 65-68 and lines 1-2, respectively. In Huttinger, "the concentrations and the partial pressures of the starting compounds of the process in the gas volume adjacent to the pore openings, which corresponds to the free reactor volume, are set to equally high levels as at the entrance to the reactor." See Column 4, lines 55-67. Accordingly, decomposition of the starting compounds in the free reactor volume is largely avoided by suitable setting of the deposition temperature and most importantly the persistence time. For this reason, only extremely short persistence times are realized. By this, decomposition reactions within the free reactor volume which are due to extended persistence times and which lead to undesirable deposition on the surface or in the pore entrances of porous substrates are avoided. See Column 4, lines 55-67. Thus, pre-reaction is carefully avoided in Huttinger unlike the present invention.

In the present invention, it is advantageous when a heat resistant material with a large surface on which the process gas is conditioned by a pre-reaction is arranged between the gas feed in the reaction space and the fiber scrims to be infiltrated. This is because it has been found that when a process gas has not been pre-reacted causes a rapid deposition on the outer surfaces of the fiber scrim and accordingly causes a sealing of its access pores. See Page 5, lines 15-20. "The reason for this is the presence of thermally unstable molecular species, primarily products with high silicon content, which form immediately after the still cool process gas enters the reaction space and which have only a short life span at the process temperature. These molecular species react on the large-surface heat-resistant material. Only molecular species with a long life reach the fiber scrim to be infiltrated and enable the deposition of silicon carbide deep into the fiber scrim." See Page 5, lines 20-26. Huttinger does not disclose arranging a heat-resistant material with a large surface between a gas feed in the reaction space and between the fiber scrims of carbon fiber preforms or silicon carbide fiber preforms to be infiltrated for pre-reacting the process gas on contact with the large surface of the heat-resistant material.

In addition, according to the present invention, in the pre-reaction, the reaction space is preheated and when the cold process gas enters the reactor space methyltrichlorosilane decomposes into thermally unstable molecular species having a high silicon content (oligomeres). Here is a simplified reaction sequence of the process gas conditioning:

$CH_3\,SiCl_3 \longrightarrow .SiCl_3 + .CH_3$

$.CH_3 + .H \longrightarrow CH_4$

$.SiCl_3 + .H \longrightarrow HSiCl_3$

$.SiCl_3 + H_2 \longrightarrow SiCl_2 + HCl$

$n .SiCl_3 + n .CH_3 \longrightarrow (SiCl_2CH_2)_n + n\,HCl$

An example of a oligomer with n=3 is a six-membered ring with alternating Si and C atoms, Si being saturated with Cl and C being saturated with H.

Molecular species like $HSiCl_3$, $SiCl_3$ and oligomers, already at moderate temperatures (at the entrance of the reactor) are readily forming a silicon and carbon containing deposit having a high silicon content. Due to the short life-span of these molecules, the surface of any preform would be sealed with silicon so that no silicon carbide could penetrate into the depth of the preforms.

In the present invention, these molecular species can be pre-reacted on the large-surface heat resistant material. Mainly, only the molecular species with a long life-span and which are stable at the process conditions, namely CH_4 and $SiCl_2$, enter the reaction (deposition) space and allow for a SiC infiltration into the depth of the preform. The surface does not become sealed so that the deposition of the silicon carbide even in the depth of the fiber scrim is possible. Thus, pre-reaction is not disclosed in Huttinger like the present invention.

Further, in regards to the process parameters of the present invention, the use of methyltrichlorosilane/hydrogen mixture as a process gas for chemical vapor deposition of SiC is a well-known method and contained in a large number of patents based on it. However, Embodiments 3 and 8 of Huttinger contain very different values. Embodiment 3 of Huttinger is directed to deposition of carbon from a methane-containing process gas and Embodiment 8 discloses a MTS/hydrogen chloride mixture, i.e. hydrogen is id replaced by hydrogen chloride. See Column 18, lines 1-12 and lines 56-62. These Embodiments cannot be compared to the present invention since chemical deposition systems and there physical process parameters may not be simply combined with each other. It is known to those skilled in the art that each system requires its own parameters. Accordingly, Huttinger does not disclose each and every claim element of the claimed invention. Therefore, Applicants respectfully requests that the rejection under 35 U.S.C. § 102 (b) be reconsidered and withdrawn.

Rejection Based On Huttinger In View of Murphy Under 35 U.S.C. § 103 (a)

The Examiner rejects Claims 10-12 under 35 U.S.C. § 103 (a) as being unpatentable over WO 98/21163 to Huttinger et al. ("Huttinger") and further in view of U.S. Patent No. 4,407,885 to Murphy et al. ('Murphy"), as applied to currently amended Claim 15. Applicants respectfully traverse this rejection.

The Examiner acknowledges that Huttinger does not teach how the preform is made. Instead, the Examiner cites to Murphy for teaching a method of forming preforms. Thus, the Examiner concludes that it would have been obvious at the time the invention was made to a person of ordinary skill in the art to use the method taught by Murphy to construct the preforms in the process taught by Huttinger and have a reasonable expectation of success. Applicants respectfully disagree with the Examiner.

To establish obviousness of a claimed invention, all claim elements must be disclosed, taught or suggested by the prior art. As stated above, claim 15 includes a process for producing a high temperature stable fiber composite ceramic by chemical vapor infiltration with methyltrichlorosilane in hydrogen on fiber scrims of carbon fiber preforms or silicon carbide fiber preforms, wherein the partial pressure ratio of hydrogen to methyltrichlorosilane is adjusted between 4 and 8, the process further comprises: adjusting the process pressure to $\geq$ 0.6 bar absolute; adjusting the process temperature to $\geq$ 1100°C; and arranging a heat-resistant material with a large surface between a gas feed in the reaction space and between the fiber scrims of carbon fiber preforms or silicon carbide fiber preforms to be infiltrated for pre-reacting the process gas on contact with the large surface of the heat-resistant material.

Applicants agree with the Examiner that Huttinger does not teach how the preform is made. Also, as stated above, Huttinger does not teach the process for producing a high temperature stable fiber composite ceramic by chemical vapor infiltration further comprising adjusting the process pressure $\geq$ 0.6 bar absolute, adjusting the process temperature to $\geq$ 1100°C and arranging a heat-resistant material with a large surface between a gas feed in the reaction space and between the fiber scrims of carbon fiber preforms or silicon carbide fiber preforms to be infiltrated for pre-reacting the process gas on contact with the large surface of the heat-resistant material. Also, Huttinger does not teach using the process temperature that is greater than 1100 °C. Moreover, Huttinger uses a completely different substrate, namely an

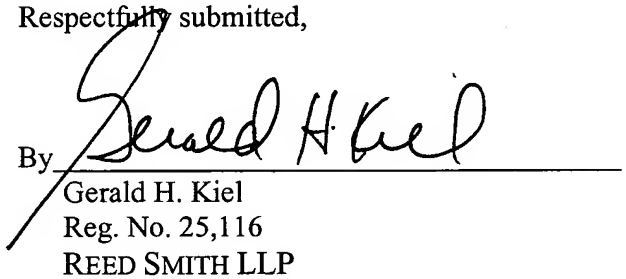
aluminum oxide substrate of an open porosity of only 23.24 %. See Col. 13, line 42. This is unlike the present invention, where the present invention is concerned with the production of fiber-reinforced ceramics and thus starts from ceramic or carbon fiber as a substrate, where the fiber content is about 42 to 44 vol. %. See page 6, lines 1-8. This corresponds to an open porosity of more than 56 vol. %. Accordingly, the form and distribution of porosity in the substrates of Huttinger and that of the present invention are completely different. Further, the second type of substrate used in Huttinger, namely the carbon fiber felt is clearly different from the inventive preforms. See Col. 17, lines 18-23. From the explanation directed to pore volume and fiber volume a fiber volume proportion of 11 % can be derived, that is, a felt with a typical low value. In contrast, the inventive fiber preforms, as previously explained, have fiber proportion of 42-44 vol. %. See page 6, lines 1-8. In order to allow the formation of complex structures, like for example components of re-entry spacecrafts, according to the present invention, the preforms are built by using resins, that is, viscous binder. Thus, the forming and simultaneously an immediate bonding with adhesive strength are possible. Finally, the resin pyrrolysis results in a high temperature-resistant solid compatible with SiC.

Although Murphy discloses a method of making a composite fabric preform, Murphy does not cure these deficiencies of Huttinger. Further, Murphy described fiber structure, the characterizing feature of which is their content of thermoplastic fibers, a solution which is not considered in the present invention. Thus, Applicants believe that the amended invention is not obvious over the teaching of Huttinger further in view of Murphy since Huttinger and/or Murphy does not teach, disclose or suggest the present claims. Moreover, one skilled in the art would find nothing in Huttinger or Murphy alone or in combination that would disclose, teach or suggest the claimed invention or any reason for making it. Further, there is no motivation to combine the references in such a way to get the claimed invention. Therefore, an obvious rejection under 35 U.S.C. §103 (a) is improper.

In view of the remarks presented herein, it is respectfully submitted that the present application is in condition for final allowance and notice to such effect is requested. If the Examiner believes that additional issues need to be resolved before this application can be passed to issue, the undersigned invites the Examiner to contact him at the telephone number provided below.

Respectfully submitted,

Dated: August 25, 2005

By 

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